translation remarks as to this that the vinegar of the present day does not have any such property. If this commentator, however, had had even a little knowledge of chemistry, he might have remembered that the acid of vinegar may cause a considerable effervescence of carbonic acid when brought into contact with chalky or calcareous soils.

In testing the purity of minerals and precious stones the ancients seem to have acquired considerable dexterity. The use of the touch-stone (Coticula) for determining the purity of precious metals and their ores was well known to the Romans and employed with such accuracy, according to Pliny (book 33, ch. 43), that the proportion of gold, silver or copper could be told instantly, even to the smallest fraction. In detecting the imitation of gems and precious stones—concerning which Pliny (book 37, ch. 75) states that most colossal deceptions were practised and in no other kind of fraud greater profits made—the ancients were in many ways as skillful as the jewelers of to-day. They employed the balance, tested certain optical properties, and even used a scale of hardness (book 37, ch. 76), it being recognized that some stones could be scratched with a blunt knife, while others could not be marked with the hardest obsidian.

Lack of space forbids giving other examples of the methods employed by the ancients in testing the purity of the commodities of life. The examples cited however show that the fragmentary records of ancient science preserved by Pliny, full as they are of inaccuracies and absurdities, contain a large amount of reliable chemical knowledge. And if the 474 authors whom Pliny consulted in the preparation of his "History" had come down to us intact we may be sure that our knowledge not only of historical, but also of practical, chemistry would be greatly enriched.

C. A. Browne

New York

EVOLUTIONARY COLLECTIONS AS MONUMENTS TO DARWIN

To the Editor of Science: In connection with the recent announcements that special collections in honor of Darwin are to be formed at the American Museum of Natural History, and that Haeckel intends to devote the remainder of his life to his phylogenetic museum, I venture to call attention to the subjoined selections from my address, "Educational Museums of Vertebrates," before the Biologic Section of the American Association for the Advancement of Science in 1885 (see the *Proceedings*, vol. 34, and abstract in Science, September 11, 1885):

> A statue of Darwin has been unveiled in London with honorable ceremonies. What monument to his memory could be more appropriate or lasting than the formation, in all educational institutions, of collections especially designed to exhibit the facts which he made significant, and the ideas which his knowledge, his industry and his honesty have caused to underlie the intelligent study of nature throughout the world. Such collections should particularly embrace series illustrating human peculiarities, not only as to skeleton, but as to brain, heart and other organs; human resemblances to mammals in general; features that unite man with the tailless apes, and separate them from all other mammals; transitory human organs and conditions that resemble the permanent organs and conditions of other mammals, especially apes; human anomalies resembling the normal structure of apes; anomalies and malformations affecting man and other vertebrates in a similar manner; apparently useless or detrimental organs or conditions.

Burt G. Wilder

Ithaca, N. Y.,
February 13, 1909

QUOTATIONS

THE FUTURE OF YALE

If I were president of Yale! But that is inconceivable. I was never in the hereditary line of descent. Besides I stepped out of all other lines that tend toward New Haven when, forty years ago, after getting more or less ready for Yale, I went as a pioneer to untried Cornell. I went because botany and geology and European history at Cornell counted for as much as Latin or Greek; and now I have to take the consequences.

If I were president of Yale, and had the necessary power and the necessary backing, this I would surely do. I would make it Yale College or else Yale University. For the questions would lie heavily on my conscience —Should a boy go to a university for college work? Should a man go to a college for university work? Should a school for boys try to teach also men? Should a school for men teach also boys, under the same conditions and regulations, and with the same teachers?

I read not long since a well-written book, "What College for the Boy?" In this volume, Yale College receives favorable mention, and most justly. Can I imagine a cognate volume in Germany? "Welche Universität fur den Knaben?" The very title is absurd on the face of it, for the place of "Knabe" is not in the "Universität." Conversely, the function of a university is not to teach the boy but the man.

The name "university" has in Germany and in continental Europe a fairly definite meaning. In America, it means nothing in particular, except a higher school, higher than the high school. In England it often means still less—an examining board authorized to confer degrees. Let us take the German meaning—a school for men, who have finished their general culture, have ceased to be boys, and have begun preparations for life work as professional men, as teachers or as investigators. This is the meaning Johns Hopkins has brought to America, and which is recognized as a valuable but exotic attachment at Harvard, at Yale and with the rest of us.

On the other hand, we have adopted the English term "college" for a group of schools progressively diverging from the English standards, but which agree in this. Their first function is to make men out of boys, and to secure the boys' cooperation and interest in the process. Where this is best done is in the "college for the boy." Where the demands of scholarship are most strenuous, where expeditions are constantly undertaken for the conquest of the unknown, where books, apparatus and collections are greatest, that is the university for the man.

In this transition stage, we have lost sight of both ideals. Rather, we behold one of them for a time, then the other, and we rush like a school of herrings toward the light that we see for the moment.

A few years ago, almost every college pretended to be a university. Almost every college teacher thought himself engaged in research and pretended to hold in contempt the "boy" and all his own duties toward the boy. So the boy became estranged from his work, and made trouble. Thus the college ideals are again insistent. Good teaching is again the demand, and the tireless attention to details that make boy-training possible, and which shut out the teacher from research of any intensive character.

All honor to the college teacher who in all these years has never lost his head, and who has steadily, consistently and without self-compromise done his duty in making boys into men. He finds them just as plastic as they ever were, and his reward as ever is in the doing.

All honor to the university teacher who abates none of his ideals, who sees the universe with a keener eye than the rest of us, and who never forgets his first duty as a seer, a prophet, a founder of a school of thought, a leader of men.

The college and the university are here, are here to stay, and here to grow and develop; but not in the same space, and still less as, at present, telescoped together. Sooner or later, we must recognize the two different functions. Sooner or later we must see that the college with its boy's play, its foot-ball team, its glee club, its need of personal inspiration, its need of rigorous moral discipline, its need of absolute inhibition of vinous conviviality, its demand for insistent training rules to prevent grafting and dissipation, is an end in itself. The glory of Yale has been that of Yale College, and Yale will have fulfilled all that a nation can ask of it if it makes Yale College the culmination of its activities. Or, Yale University may be the glory of the future—the thorough professional and technical training of men already broad-minded, clean-souled, and well-

grounded in all that the college can give in its four years of fellowship, aspiration and discipline. (These four years ought to end as they did thirty years ago, with the year we now call "sophomore," but that is another story.) But Yale College and Yale University, all together and equally great, that can never be.

Yale University needs books, apparatus, collections, long-striding scholars and founders of dynasties of scholarship and research. Yale University needs millions; Yale College has enough. But Yale College and Yale University in one yard, under one body of teachers, under one set of discipline, and forever getting in each other's way; this condition can never be a finality. Until they are separated in space, as in time, Yale College can not escape the reproach all our colleges bear, that she neglects her boys in the imagined interest of research; that her professors do not love their work, and slight it in many ways; that if the boy becomes a man the college deserves no thanks for it.[1] On the other hand, Yale University will find itself blamed for contributing so little to the advance of knowledge. With a staff as large as that of Leipzig, more or less, and an equivalent student body, its scholarly output is less than half that of the German institution. This sort of criticism we hear again and again. Whether this be just or not is a minor question. People think that it is true, and it will be essentially true so long as Yale College is interchangeable with Yale University.

Were I president of Yale, I would cling to the one ideal or the other, letting all else go. For the time must come when our colleges can not fulfill our university ideals, by adding scantily equipped professional schools and hiring a dozen or two graduate students to shift for themselves under overworked professors. Meanwhile, our universities can not make men out of boys unless they address themselves most seriously to the business, "bringing every ray of various genius to their hospitable halls" that through their united influence "they may set the heart of the youth in flame."

You will see that this applies to Yale no more and no less than to Harvard, to Cornell, to Wisconsin and to any other institution which is trying to do boy's work and man's work at the same time, in the same place, and by the same educational machinery. We have just now referred to the University of Leipzig. Let us suppose that to her three thousand students, more or less, she should add as many more from the higher grades of the gymnasium or high school, corresponding to our freshmen and sophomores. Let us suppose that she should add to her faculty of three

[1] Says Dr. George E. Vincent, a dean of the University of Chicago: "The chief causes which are alleged to be responsible for a perceptible lowering of the standard of student work are: less definite and disciplinary instruction in the elementary and secondary schools; an elective system permitting a haphazard, desultory, individual course; the presence of an idle rich class setting a standard of ostentation and luxury; the exaltation of competitive athletics and the heroizing of successful athletes; the growth of fraternities with their time-consuming activities and social distinctions; the emphasis on social life and the consequent prejudice against the diligent student who takes little part in the 'valuable education outside the classroom'; the over-crowding of classes so that attention to individual students is difficult or impossible; the introduction of the lecture system for undergraduates accustomed to the drill of the recitation method; the putting of young, inexperienced, overworked and illpaid instructors in charge of freshmen and sophomore divisions; the competition between instructors in offering popular, largely elected, and too often 'snap' or 'soft' courses; the exaltation of research at the expense of 'mere teaching' and the consequent lowering of teaching efficiency; the extension of the doctrine of freedom of teaching to protect a careless or inefficient instructor of elementary courses from investigation; failure to make college work seem vital to the student, a means to his personal ends, in marked contrast with the success of the professional schools which hold up a definite goal, arouse interest and enforce a higher standard of effort and accomplishment. The mere enumeration of these charges raises many questions of fact and interpretation. That some if not all of the influences are present in all of our colleges is not to be denied."

hundred professors, more or less, as many gymnasium drill masters. Let us suppose that the resultant multitude were called a university. It would be just the same sort of a university we have developed in America, a place where men and boys are gathered together, each in the other's way, and where neither ideals of scholarship nor ideals of man-making can reach their most perfect achievement.—President David Starr Jordan, in *The Yale News*.

SCIENTIFIC BOOKS

Conditions of Life in the Sea. A Short Account of Quantitative Marine Biological Research. By JAMES JOHNSTONE. Pp. 332. Cambridge Biological Series, Cambridge University Press. 1908.

Many good things must be, and a few bad things ought to be, said about this book. Since it is more agreeable to speak well than ill, we will occupy ourselves first and chiefly with what is good.

The broader value of the work is two fold.

In the first place it affords an easy, reliable opening into an important, rapidly growing field of knowledge that hitherto has not been readily accessible to general readers, nor indeed to special scientific students. The field to which reference is made is marine biology as developed particularly by the countries bordering on the North Sea. Many professional biologists, especially in America, have not yet had brought home to them the fundamental nature of various conceptions and methods involved in these investigations.

In the second place the book is noteworthy for biology generally from the consistency with which the quantitative standpoint is maintained. The reviewer does not recall another semi-popular work in which organisms are regarded in a quantitative way for so wide a range of their relationships. In this the book may be looked upon as a harbinger of what biological treatises of general character will be in the future. This statement tells at once that the author is enrolled in the so-called Hensen or Kiel school of marine biologists.

Much criticism has been passed upon both the methods and results of this school. One may be indeed justifiably sceptical concerning the value of the particular calculation that a square mile of the water of the Baltic Sea contains 80 to 100 billion copepods, or that there were 180,139,000 haddock in the whole North Sea during the spring of 1895. The chief interest in the calculation lies in its significance concerning what biology's attitude toward its problems may be. In a given limited area of the ocean, the North Sea for example, there is at a given time *some* limited number of haddock. Finite quantities of substances and bodies and forces are the very foundation stones of all physical science, biology with the rest, and sooner or later as knowledge advances, values for these quantities are bound to be sought. When fishing industries unite with clearly perceived biological problems in demanding information as to how many herring there are in the North Sea, and how much food is available for them, to get such information is exactly part of the business of science. If the first attempts are not sufficiently reliable, others with better methods must be made. For biology to take the ground that such researches can not be successful, nor would be significant if they were, would be to acknowledge itself stunted in its early youth.

The book is divided into three parts. Part I. designated introductory, contains in the first place a general description of the apparatus and procedures used in the most advanced marine biological researches. An account of certain aspects of oceanography is also given as is a very general survey of the Life of the Sea. Such topics as bottom deposits, composition, temperature, transparency and circulation of the waters are touched upon.

Under the heading Life in the Sea the zones of littoral life, bottom dwellers, or the benthos, and the free life, or the nekton and plankton, and kindred subjects are spoken of and several figures showing characteristic pelagic invertebrates and algæ are given. This part ends with a chapter on sea fisheries.

The real essence of the volume is in parts II. and III., designated respectively Quanti-